A proposal for a LCA community knowledge management system

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ABSTRACT

Practitioners conducting life cycle assessments are uniquely dependent on data collected or published by their colleagues. To meet the LCA community's strong need for transparent, quality, regionally-relevant data, this paper proposes the development of an online LCA-community knowledge management system (KMS). An online LCA-community KMS could provide the means for the global LCA community to collaboratively create, store, review and compare LCI data. In conjunction with the LCI data store the KMS could provide for an online publication knowledgebase with the ability for authors to provide further clarification of the data collection and analysis methods used in their publications. Finally, an LCA-community KMS could adapt features of various social software applications to provide even more avenues for members to collaborate, to share and to learn from one another.

Keywords: online community, knowledgebase, LCA, LCI, knowledge management system

1. Introduction

Life Cycle Assessment (LCA) practitioners are uniquely dependent on data collected and published by their peers. An LCA of even a modest product supply chain can easily require data for hundreds or even thousands of unit processes. And in today's global economy the data requirements for upstream and downstream supply chain inputs can span the globe. This quantity and scope of data collection is beyond the budget and time allowances of almost all individual LCA projects. Consequently practitioners source data from wherever they can find it. Commercial databases with regionally based data will most likely have to be modified. Journal or conference publications have paper length restrictions that lead to insufficient descriptions of methodological choices. Sometimes processes are deemed to be insignificant, or at least unavailable, and their data are simply omitted (Suh, Lenzen et al. 2004; Gnansounou, Dauriat et al. 2009).

The LCA community has a strong need for transparent, quality, regionally relevant data. There is also a corresponding need for access to and a shared knowledge of community approved processes for conducting a life cycle assessment. The ISO 14040/44 standards provide the general framework for conducting an LCA. However the practitioner is still required to make many choices that can change the assessment's results and conclusions. In essence, LCA practitioners need to have access to community approved data, processes and best practices in order to ensure the quality and consistency of life cycle assessments conducted by the LCA community.

Knowledge of organisational processes and best practices has long been recognized by firms as a valuable resource and a key part of their competitive advantage (Wasko and Faraj 2000). In an attempt to "facilitate the sharing and integration of knowledge" (Alavi and Leidner 1999, p. 1) firms have employed information and communication technologies to build knowledge management systems (KMS). A knowledge management system refers to

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a system for managing knowledge in organizations. A KMS provides support for the creation, capture, storage and dissemination of information. The underlying design of these management systems is highly dependent on how knowledge is perceived.

Three perspectives of knowledge have emerged from research on organizational knowledge practices: knowledge as object, knowledge embedded in people, and knowledge embedded in a community. The first two perspectives view knowledge as a private good, a commodity that can be bought and sold like any other item. The third perspective, knowledge embedded in community, "views knowledge as a public good that is socially generated, maintained, and exchanged within emergent communities of practice" (Wasko and Faraj 2000, p. 156). It is this third perception of knowledge, knowledge embedded in community, which will form the basis for the underlying design of the proposed LCA community KMS.

2. Purpose of the research and research questions

2.1. Background

With today's Internet technologies, anyone with an Internet connection can easily publish knowledge and collaboratively create and share data (Shirky 2008). The free open source software (FOSS) movement were early adopters of this way of working together. A community of developers will typically 'meet' on special community web sites, such as SourceForge.net. Their knowledge creation and sharing is socially generated, maintained and exchanged via forums, mailing lists, wikis and blogs. The source code and applications are generally considered a public good and made available to the general public. Linux and Firefox are just two of many open source products created by the FOSS community. The open source software development model illustrates the scope and power of knowledge embedded in community. So does Wikipedia, the multi-lingual, web-based, free-content encyclopaedia project.

An example of a FOSS project within the LCA community is the openLCA project whose goal is to develop modular software for life cycle analysis and sustainability assessments. Like any other open source project, the openLCA project survives and thrives based on the contributions of its community.

The power to collaboratively generate, maintain and exchange knowledge can also be available to the global LCA community through an online community based KMS. An LCA community KMS could employ information and communication technologies to allow its practitioners to share and integrate the knowledge that is crucial to the LCA community. This crucial knowledge could include:

- access to and the ability to collaboratively generate and maintain transparent, quality, regionally relevant LCI data;
- guidelines for accepted processes and best practices in conducting a life cycle assessment; and
- a publication knowledgebase where authors could provide further clarification of the data collection and analysis methods used in their publications.

Some of this crucial information is already available to the community. Quality regionally relevant LCI data is available from several sources: the ELCD database for the European market, the US LCI database, and the AusLCI for Australia. The ILCD Handbook provides guidelines for accepted processes and best practices. The LCT forum provides a mailing list service where members can post and answer LCA related questions and gain access to global life cycle expertise.

However each of these exists as a separate isolated element, knowledge as object. If we accept the perception of knowledge embedded in community, than the true shape of an online LCA community KMS must allow for knowledge to be socially generated, maintained, and exchanged online. Not disparate elements existing in isolation online but one virtual 'meeting place' which has links to existing global LCA community information but also provides the means for any member of the global community to make a contribution.

The power of the open source software model, where knowledge is embedded in the community, means that each individual member's contribution added to the collective knowledge creates a richer knowledgebase of ideas and data than would be available to any one member working alone (Bell 2009).

2.2. Research questions and strategy

The proposed LCA community KMS is at its core an information system. Its development will therefore follow a typical Systems Development Life Cycle (SDLC): initiation and planning, requirements gathering and analysis, systems design, development, testing, implementation, and maintenance. This paper discusses the first two phases of the SDLC.

The initiation and planning phase of the SDLC defines a need and identifies the scope of the system to be developed to meet this need. The LCA communities need for transparent, quality, regionally relevant data, and access to community processes and best practices were discussed above.

The second phase, requirements gathering and analysis, involves communicating with key stakeholders to establish a group consensus on the system's requirements. To fulfil this phase, input will be sought from the LCA community to assist in identifying a list of system requirements based on the following research questions:

RQ1: What features must the KMS possess to motivate members to identify with and become active participants of their online community?

RQ2: What types of capabilities must the KMS provide to meet the LCA community's need for transparent, quality regionally relevant data?

RQ3: What types of activities must the KMS facilitate to enable members to collaborate with, to share and to learn from one another?

A requirement gathering typically uses an iterative feedback technique to obtain the most reliable group consensus. The process usually starts with a brainstorming/open-ended solicitation of ideas and ends with as close to a group consensus as is feasible.

In the interest of starting the brainstorming of ideas, the rest of this paper discusses the authors' personal opinions of some of the features, capabilities and activities that could be incorporated into the LCA community KMS.

3. An LCA Community KMS

Business and government policy makers increasingly base their decisions on published LCA reports. LCA practitioners themselves frequently use the published results of other papers for comparisons to their results or even as sources for missing data.

For LCA results to be transparent and comparable the reader needs all relevant information concerning the inventory data selected, the assumptions made to complement unavailable data and modelling choices about system definition and boundaries, functional units, reference systems and allocation methods. Unfortunately, whether due to lack of data or insufficient space to fully report all of the methodological choices made, many LCA publica-

tions provide insufficient information to make such quantitative comparisons with any confidence. And even if sufficient information is available, the supply chain modelled and its inputs can be unrepresentative of local regional inputs. For example, the differences between modelling a simplified piggery ration in an Australian pork supply chain compared to a European one (Wiedemann, McGahan et al. 2010).

The published values for a European pork LCA simplified piggery ration were based on a marginal grain (barley) and soybean meal imported from Argentina (Dalgaard, Halberg et al. 2007). But Australia is a major grain exporter. It does not in fact import any grain, only some grain by-products like soybean meal. A simplified Australian piggery ration has to model sorghum as the marginal grain. While the published energy inputs for milling of soybeans and canola (rapeseed) in Argentina were used, the soybeans had to be modelled based on a mix of imported (US) and Australian domestic production.

3.1. Publication Knowledgebase

An online LCA community KMS can provide a place for LCA practitioners to provide detailed information on the methodological choices made for their own publications and ask questions regarding other member's publications. All supplemental information provided for a publication could be linked to, and accessible with, that publication. Providing the means for further clarification in an online forum makes the knowledge available to all members. Members could make more informed decisions on which publications to use for comparison or as data sources. Business and government policy makers could have more confidence in their analysis of the publication's results.

Beyond this basic dissemination of information, an online KMS could allow LCA community members around the globe to collaboratively create and share their knowledge. A publications area of a KMS can serve as a repository for the community's general LCA references.

For example, each community member could upload their own EndNote reference libraries to the publication knowledgebase. The references uploaded would be available to the community as a whole. Community members could add their own reviews, citations and keywords for each publication in the knowledgebase. Also, each member could create and manage their own personal library based on selections from the entire publications knowledgebase. Member libraries could be downloaded, in whole or in part, as new EndNote reference library files. Where electronic versions are available and copyright permits, publications could be uploaded to and downloaded from the repository; otherwise links to online versions could be provided.

As more and more publications and their associated metadata are added to the knowledgebase, its value grows. The community's collective contributions create a richer knowledgebase available to the community as a whole than would have ever been available to any member through their own individual efforts.

A publication knowledgebase is one component of a LCA community KMS. Another key component for the LCA community is the facility to link publications with their LCI data.

3.2. LCI Data Store

The methodological choices made while defining the goal and scope step of a LCA greatly influence the gathering and selection of its LCI data. Since a LCA of even a modest supply chain can involve collecting data for hundreds of individual supply chain steps, i.e. unit processes, practitioners are uniquely dependent on data collected by their colleagues.

Given this dependency, the LCA community has a corresponding requirement for transparent, quality, regionally relevant data.

The publications knowledgebase can provide the means for clarifications on methodological choices made for a LCA publication. A LCI data store, in conjunction with a publications knowledgebase, would provide the means to make direct linkages between a publication's LCA results and the LCI data on which the results were based; thus increasing both the transparency of and the confidence in the publications results and in the usability of the LCI data for other life cycle assessments.

The LCI data store could consist of both complete unit process data files and unit process reference files. Unit process data files would provide complete data for a specific step in a supply chain, for example the input and output material and energy flows required to produce one tonne of sorghum on a farm in South East Queensland.

Unit process reference files could be used for data available in external databanks such as ELCD or Ecoinvent. A reference file could provide a link to where the unit process data and its meta-data describing functional units, included impact categories, etc could be accessed.

This form of an online data store could provide the means for community members to objectively review and compare data. It could also allow the means for community members to collaboratively create and share LCI data.

The KMS could provide the means for members to register their interest in specific types of data. Members with similar data requirements could form data interest groups who could collaboratively create and share data which follows a consistent protocol.

The KMS has the potential to allow LCA community members to gain access to valuable information they need to do their jobs and have their contributions open for peer review. LCA community members could therefore gain recognition for their areas of expertise and become more visible to the global LCA community.

3.3. Collaboration and More

Beyond the publications and data store sections of the KMS, other Internet technologies could provide ways for community knowledge to be socially generated, maintained and exchanged. Blogs, wikis and videos could be used to provide tutorials for conducting some of the more complicated LCA processes. Forums could be employed for community discussions on topics such as the adoption and appropriate use of a new impact category. Popular features of current social software applications could also be adapted.

One potential adaptation that could add value to the KMS is Amazon-style reviews for the publications. Amazon taps into the expertise and opinions of its customers by encouraging them to post reviews of their products. Undecided customers gain the advantage of the opinions of reviewers familiar with the product. The review system also allows customers to rank the usefulness of a reviewer's posting. Reviewers whose postings are consistently ranked as 'useful' have this higher level of confidence delineated next to their postings; providing an additional dimension of confidence in the reviewer's opinion.

This style of review system could be a very valuable addition to the publication knowledgebase. Publication authors get feedback, the reviewer gets feedback, good reviewers can establish a reputation for providing useful advice, and community members gain the advantage of other member's viewpoints regarding the value of a publication.

Another popular social software feature that could be adapted is iTunes Playlists. iTunes is a software application that allows users to organize their music. iTunes Playlists allow users to create song 'collections' based on artist, genre or use. Playlists can be shared with others by publishing them on the iTunes Store.

An iTunes-style Playlist for publications would allow members to create and share topical lists of publications. Unlike keywords which generally refer to the content of a publication, a Publist would provide a means to organize publications based on how they are used. A Publist for 'Australian Pork' could include publications on Australian grain production, regional farm processes, references to percentages of fertiliser imports, etc. Publists would provide a means of associating a publication with its relevant reference material, i.e. LCI data, allocation methods, etc. Creating such a project specific Publist would provide a way for experienced members to organize a project's reference material for easier documentation and retrieval. Sharing this type of Publist with the community would allow other members to gain insight into the standards and practices followed for the life cycle assessment. Transparency in methodological choices and data sources could increase the perceived value of and confidence in a publications result.

4. Conclusion and outlook

An online LCA community KMS provides the means for the global LCA community to collaboratively create, store, review and compare LCI data. In addition, a LCA-community KMS could provide the means for experienced LCA practitioners to share their knowledge and have their expertise recognised by the larger community. For newer members, a community based KMS could provide access to a collective knowledgebase of expertise and the opportunity to learn from and adopt the community's standards of practice.

With an online LCA community KMS, opportunities to collaborate, to learn, to share and to be recognized could all be viable and offer enormous potential. This paper proposes the development of an LCA community KMS, designed by and developed for the LCA community. Construction of the KMS will occur over the next few years. Its creation will require community input. Its success will require community participation, one member at a time.

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